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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	K. HONDA et al.
Serial No.	:	10/532,854
Filed	:	April 27, 2005
For	:	HIGHLY CORROSION-RESISTANT HOT-DIP GALVANIZED STEEL PRODUCT EXCELLENT IN SURFACE SMOOTHNESS AND FORMABILITY AND PROCESS FOR PRODUCING SAME
Examiner	:	Jason L. Savage
Art Unit	:	1794
Confirmation No.	:	1971

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Signature: /Katy Chan-Parsons/
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APPEAL BRIEF PURSUANT TO 37 C.F.R. § 41.37

On July 21, 2010, Appellants submitted a Notice of Appeal from the last decision of the Examiner contained in the Final Office Action, dated January 22, 2010, in the above-identified application. Based on the date stamp on the copy of the Notice of Appeal available on the U.S. P.T.O. PAIR website, it is Appellants understanding that that the Notice of Appeal was received by the United States Patent and Trademark Office on July 26, 2010.

In accordance with 37 C.F.R. §41.37, this Appeal Brief is submitted in support of the appeal of the final rejection of claims 1, 2, and 10 to 13. For at least the reasons set forth below, the final rejection of claims 1, 2, and 10 to 13 should be reversed.

1. REAL PARTY IN INTEREST

The real party in interest in this appeal is Nippon Steel Corporation, the Assignee of the entire right, title, and interest in and to the present invention.

2. RELATED APPEALS AND INTERFERENCES

There are no other prior or pending appeals, interferences, or judicial proceedings known by the undersigned, or believed by the undersigned to be known to Appellants or the Assignee, Nippon Steel Corporation, "which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal."

3. STATUS OF CLAIMS

Claims 3 to 9 have been canceled.

Claims 1, 2, and 10 to 13 stand rejected under 35 U.S.C. § 102(b), as allegedly being anticipated by or, in the alternative, under 35 U.S.C. § 103(a), as allegedly being obvious over the English machine translation of Japanese Application Publication No. 2002-187234 to Fumishiro et al. (Fumishiro).

4. STATUS OF THE AMENDMENTS

In response to the Office Action dated April 16, 2009, Appellants electronically submitted an Amendment on October 14, 2009. The Final Office Action states that that Office Action is responsive to the Amendment submitted on October 14, 2009. As such, it is Appellants' understanding that the Amendment submitted on October 14, 2009, has been entered.

5. SUMMARY OF CLAIMED SUBJECT MATTER

All of the claims on appeal are independent.

Independent claim 1 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The presently claimed steel product has, on the steel product surface, a 10 to 350 g/m^2 zinc alloy plating layer. *Specification*, page 13, lines 24 to 27. The zinc alloy plating layer consists of 4 to 10 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 6 to 11. The plating layer has a metal structure in which one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 3, lines 11 to 15. The plating layer contains a Ti-Al base intermetallic compound composed of $TiA1_3$ in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase]. *Specification*, page 3, lines 15 to 18.

The Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed. *Specification*, page 4, lines 30 to 36. The size of a dendrite in an [Al phase] in the plating layer is up to 500μm. *Specification*, page 5, lines 3 to 4.

Independent claim 2 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The steel product has, on the steel product surface, a 10 to 350 g/m^2 zinc alloy plating layer. *Specification*, page 13, lines 24 to 27. The zinc alloy plating layer consists of 4 to 22 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti, up to 0.5 percent by mass of Si and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 19 to 25. The plating layer of the plated steel product has a metal structure in which an [Mg_2Si phase], an [Al phase], a [Zn_2Mg phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 4, lines 1 to 5. The plating layer contains a Ti-Al base intermetallic compound consists of Ti $(Al_{1-x}\ Si_x)_3$ (where X = 0 to 0.5) in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase]. *Specification*, page 4, lines 5 to 7 and 25 to 29.

The Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed. *Specification*, page 4, lines 30 to 36. The size of a dendrite in an [Al phase] in the plating layer is up to 500μm. *Specification*, page 5, lines 3 to 4.

Independent claim 10 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The steel product has, on the steel product surface, a zinc alloy plating layer consisting of 4 to 22 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti, up to 0.5 percent by mass of Si and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 19 to 25. The plating layer of the plated steel product has a metal structure in which an [Mg_2Si phase], an [Al phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 4, lines 14 to 17. The plating layer containing a Ti-Al base intermetallic compound consists of Ti $(Al_{1-x}\ Si_x)_3$ (where X = 0 to 0.5) in one or more of the [Al phase] and [Zn phase]. *Specification*, page 4, lines 14 to 17 and 25 to 29.

The Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed. *Specification*, page 4, lines 30 to 36.

Independent claim 11 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The steel product has, on the steel product surface, a zinc alloy plating layer consisting of 4 to 10 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 6 to 11. The plating layer has a metal structure in which one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 3, lines 11 to 15. The plating layer containing a Ti-Al base intermetallic compound consists of $TiA1_3$ in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase]. *Specification*, page 3, lines 15 to 18; page 4, lines 20 to 24. The size of a dendrite in an [Al phase] in the plating layer is up to 500μm. *Specification*, page 5, lines 3 to 4.

Independent claim 12 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The steel product has, on the steel product surface, a zinc alloy plating layer consisting of 4 to 22 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti, up to 0.5 percent by mass of Si and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 19 to 25. The plating layer of the plated steel product has a metal structure in which an [Mg_2Si phase], an [Al phase], a [Zn_2Mg phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 4, lines 1 to 5. The plating layer containing a Ti-Al base intermetallic compound consists of Ti $(A1_{1-x}\ Si_x)_3$ (wherein X = 0 to 0.5) in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase]. *Specification*, page 4, lines 5 to 7 and 25 to 29. The size of a dendrite in an [Al phase] in the plating layer is up to 500μm. *Specification*, page 5, lines 3 to 4.

Independent claim 13 relates to a highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability. *Specification*, page 2, lines 31 to 32; page 3, lines 6 to 8. The steel product has, on the steel product surface, a zinc alloy plating layer consisting of 4 to 22 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti, up to 0.5 percent by mass of Si and a balance of Zn and unavoidable impurities. *Specification*, page 3, lines 19 to 25. The plating layer of the plated steel product has a metal structure in which an [Mg_2Si phase], an [Al phase], and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure]. *Specification*, page 4, lines 14 to 17. The plating layer containing a Ti-Al base intermetallic

compound consists of Ti $(Al_{1-x}Si_x)_3$ (where X = 0 to 0.5) in one or more of the [Al phase] and [Zn phase]. *Specification*, page 4, lines 18 to 19 and 25 to 29. The size of a dendrite in an [Al phase] in the plating layer is up to 500 μm. *Specification*, page 5, lines 3 to 4.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1, 2, and 10 to 13 are patentable under 35 U.S.C. §§ 102(b) and 103(a) over Japanese Application Publication No. 2002-187234 to Fumishiro et al.

7. ARGUMENT

Claims 1, 2, and 10 to 13 stand rejected under 35 U.S.C. § 102(b), as allegedly being anticipated by or, in the alternative, under 35 U.S.C. § 103(a), as allegedly being obvious over the English machine translation of Japanese Application Publication No. 2002-187234 to Fumishiro et al. (Fumishiro), for the reasons set forth on pages 2 to 4 of the Final Office Action. A Response to Arguments section, in which the Examiner responds to the Arguments submitted by Appellants in the Amendment dated October 14, 2009, is set forth on pages 4 and 5 of the Final Office Action.

In the Amendment dated October 14, 2009, Appellants amended the claims to change the recitation of "composed of" to ---consisting of--. Therefore, the zinc alloy plating layer of the presently claimed highly corrosion-resistant hot-dip galvanized steel product, as recited in claims 1 and 11, is limited to 4 to 10 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti and a balance of Zn and unavoidable impurities, and, as recited in claims 2, 10, 12, and 13, is limited to 4 to 22 percent by mass of Al, 1 to 5 percent by mass of Mg, up to 0.1 percent by mass of Ti, up to 0.5 mass percent Si, and a balance of Zn and unavoidable impurities. A prior art reference that discloses any additional components is outside the scope of the present claims, and does not anticipate or render obvious the present claims.

Appellants argued in the Amendment dated October 14, 2009, that Fumishiro is cited in the Office Action for the disclosure of a corrosion resistant hot-dip galvanized steel having a zinc alloy surface coating comprising 4 to 22 percent Al, aluminum, 1 to 4 percent Mg, magnesium, up to 0.1 percent Ti, titanium, and up to 0.5 percent Si, silicon, and that phases of $Al/Zn/Zn_2Mg$ are formed. Applicants submit that Fumishiro also discloses that the zinc alloy surface coating may also contain up to 0.045 percent B, boron. *See, e.g.*, the Abstract.

Appellants also argued that, in paragraph [0009], Fumishiro discloses that the inclusion of Ti and B can be included in a Zn-Al-Mg system hot-dipping layer to control the

generation and growth of a $Zn_{11}Mg_2$ interlayer. In paragraphs [0016], [0017], and [0018], Fumishiro again discloses that the presence of a Ti-B system in the hot-dipping layer.

It will be understood by those skilled in the art that the presence of the Ti-Al intermetallic compound, recited in the present claims, requires the presence of Ti in the hot-dipping layer disclosed by Fumishiro.

In addition, Appellants argued that Fumishiro clearly discloses that when Ti is present in the hot-dipping layer, B must also be present, citing Fumishiro, paragraphs [0009] and [0016] to [0018]. Therefore, to obtain a hot-dipping layer containing the Ti-Al intermetallic compound recited in the present claims in the hot-dipping layer disclosed by Fumishiro, Fumishiro requires that the hot-dipping layer must also contain B. That places the disclosure of Fumishiro outside the scope of the present claims, as Fumishiro only discloses two types of hot-dipping layers:

Hot-dipping layers that lack Ti, and, thus, lack the Ti-Al intermetallic compound recited in the present claims; and

Hot-dipping layers containing Ti and B.

Therefore, Fumishiro does not disclose a hot-dipping layer that contains a Ti-Al intermetallic compound that is also free of B. The hot-dipping layers disclosed by Fumishiro are outside the scope of the present claims, and provide no reason for one of ordinary skill in the art to make or use the presently claimed steel product.

In response to Appellants arguments, the Examiner states in the Final Office Action that:

Fumishiro never recites that Ti must be added in combination with B;

In the Abstract, Fumishiro teaches that the coating may contain 0 percent B; and

There is no disclosure in Fumishiro that recites that Ti and B must be added in combination or not at all.

Appellants submit that those statements regarding the lack of teaching by Fumishiro that Ti and B are added together are clearly incorrect.

First, in the Abstract, Fumishiro discloses that neither Ti nor B is required in the disclosed galvanized layer. Therefore, Fumishiro discloses coating layers that do not include Ti, which is required in the presently claimed steel product.

Fumishiro then teaches that it is the combination of Ti and B that is required to provide control of $Zn_{11}Mg_2$.

In paragraph [0015], Fumishiro teaches the crystallization of a $Zn_{11}Mg_2$ phase spoils the appearance of the hot-dipping layer, and reduces corrosion resistance. Thus, from the

teaching of Fumishiro, one of ordinary skill in the art will understand that the presence of a $Zn_{11}Mg_2$ phase adversely affects the hot-dipping layer, and must be controlled.

In paragraph [009], Fumishiro then teaches that, when Ti and B are included in a Zn-aluminum-Mg system hot-dipping layer, the generation and growth of $Zn_{11}Mg_2$ is controlled.

In paragraph [0016], Fumishiro teaches that generation and growth of a $Zn_{11}Mg_2$ phase are notably controlled by the addition of more than 0.002 mass percent Ti and more than 0.001 mass percent B, and the suppression is sufficient to prevent an adverse unevenness of the a hot-dipping layer surface of the coated steel sheet.

In paragraph [0017], Fumishiro again teaches that Ti and B are added to control the generation and growth of $Zn_{11}Mg_2$.

Finally, in paragraph [0018], Fumishiro again discusses a Ti-B system.

Therefore, one of ordinary skill in the art will clearly understand from the teaching of Fumishiro that it is the combination of Ti and B that controls the generation and growth of $Zn_{11}Mg_2$, and that the combination of Ti and B is required to control the generation and growth of $Zn_{11}Mg_2$.

Fumishiro does not disclose any steel plating composition that does not contain B when Ti is present. Therefore, Fumishiro does not anticipate the present claims.

One of ordinary skill in the art, following the disclosure of Fumishiro would not add Ti without also adding B. Fumishiro provides no reason for one of ordinary skill in the art to add Ti without also adding B. Therefore, the present claims are not obvious over Fumishiro.

As discussed above, Fumishiro discloses only two types of hot-dipping layers:

Hot-dipping layers that lack Ti, and, thus, lack the Ti-Al intermetallic compound recited in the present claims; and

Hot-dipping layers containing Ti and B, where the addition of B places the disclosure of Fumishiro outside the scope of the present claims.

Therefore, the present claims are not anticipated by or obvious over Fumishiro. Fumishiro does not disclose or suggest the presently claimed steel product, and Fumishiro fails to provide any reason for one of ordinary skill in the art to make and/or use the presently claimed steel product. Accordingly, Appellants respectfully submit that the rejections of claims 1, 2, and 10 to 13 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) are improper, and should be reversed.

8. Claims Appendix

A "Claims Appendix" is attached hereto, and appears on the two (2) pages numbered "Claims Appendix 1" and to "Claims Appendix 2."

9. Evidence Appendix

No evidence has been submitted. An "Evidence Appendix" is nevertheless attached hereto and appears on the one (1) page numbered "Evidence Appendix 1."

10. Related Proceedings Appendix

As indicated in Section 2, above, "[t]here are no other prior or pending appeals, interferences, or judicial proceedings known by the undersigned, or believed by the undersigned to be known to Appellants or the Assignee, Nippon Steel Corporation, 'which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.'" As such, there are no "decisions rendered by a court or the Board in any proceeding identified pursuant to [37 C.F.R. § 41.37(c)(1)(ii)]" to be submitted. A "Related Proceedings Appendix" is nevertheless attached hereto and appears on the one (1) page numbered "Related Proceedings Appendix 1."

11. Conclusion

For the reasons set forth above, Appellants respectfully submit that the cited reference does anticipate or render obvious the present claims. Therefore, it is respectfully submitted that the subject matter set forth in the claims of the present application is patentable.

In view of the foregoing, Appellants respectfully request reversal of all of the rejections set forth in the Final Office Action.

Respectfully submitted,

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Dated: February 28, 2011

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CLAIMS APPENDIX

1. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a 10 to 350 g/m^2 zinc alloy plating layer consisting of 4 to 10% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti and a balance of Zn and unavoidable impurities, the plating layer having a metal structure in which one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound composed of $TiAl_3$ in one or more of the [Al phase], [Zn_2Mg phase]and [Zn phase],

wherein the Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed, and the size of a dendrite in an [Al phase] in the plating layer is up to 500μm.

2. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a 10 to 350 g/m^2 zinc alloy plating layer consisting of 4 to 22% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti, up to 0.5% by mass of Si and a balance of Zn and unavoidable impurities, the plating layer of the plated steel product having a metal structure in which an [Mg_2Si phase], an [Al phase], a [Zn_2Mg phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound consisting of Ti $(Al_{1-x}Si_x)_3$ (wherein X = 0 to 0.5) in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase],

wherein the Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed, and the size of a dendrite in an [Al phase] in the plating layer is up to 500μm.

10. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a zinc alloy plating layer consisting of 4 to 22% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti, up to 0.5% by mass of Si and a balance of Zn and unavoidable impurities, the plating layer of the plated steel product having a metal structure in which an [Mg_2Si phase], an [Al phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound consisting of Ti $(Al_{1-x}Si_x)_3$ (wherein X = 0 to 0.5) in one or more of the [Al phase] and [Zn phase],

wherein the Ti-Al base intermetallic compound contained in an [Al phase] in the plating layer is present in a Zn-Al eutectoid reaction structure in which Zn phases are condensed.

11. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a zinc alloy plating layer consisting of 4 to 10% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti and a balance of Zn and unavoidable impurities, the plating layer having a metal structure in which one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound consisting of $TiA1_3$ in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase],

wherein the size of a dendrite in an [Al phase] in the plating layer is up to 500μm.

12. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a zinc alloy plating layer consisting of 4 to 22% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti, up to 0.5% by mass of Si and a balance of Zn and unavoidable impurities, the plating layer of the plated steel product having a metal structure in which an [Mg_2Si phase], an [Al phase], a [Zn_2Mg phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound consisting of Ti $(A1_{1-x}\ Si_x)_3$ (wherein X = 0 to 0.5) in one or more of the [Al phase], [Zn_2Mg phase] and [Zn phase],

wherein the size of a dendrite in an [Al phase] in the plating layer is up to 500μm.

13. A highly corrosion-resistant hot-dip galvanized steel product excellent in surface smoothness and formability, having on the steel product surface a zinc alloy plating layer consisting of 4 to 22% by mass of Al, 1 to 5% by mass of Mg, up to 0.1% by mass of Ti, up to 0.5% by mass of Si and a balance of Zn and unavoidable impurities, the plating layer of the plated steel product having a metal structure in which an [Mg_2Si phase], an [Al phase] and a [Zn phase] are present in a mixture in the matrix of an [Al/Zn/Zn_2Mg ternary eutectic structure], and the plating layer containing a Ti-Al base intermetallic compound consisting of Ti $(A1_{1-x}\ Si_x)_3$ (wherein X = 0 to 0.5) in one or more of the [Al phase] and [Zn phase],

wherein the size of a dendrite in an [Al phase] in the plating layer is up to 500 μm.

Evidence Appendix

None

Related Proceedings Appendix

As indicated in Sections 2 and 10, above, "[t]here are no other prior or pending appeals, interferences, or judicial proceedings known by the undersigned, or believed by the undersigned to be known to Appellants or the Assignee, Nippon Steel Corporation, 'which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.'" As such, there no "decisions rendered by a court or the Board in any proceeding identified pursuant to [37 C.F.R. § 41.37(c)(1)(ii)]" to be submitted.